

CLAIMS

1 1. A method for detecting beats in a compression encoded audio bitstream, said
2 method comprising the steps of:

3 determining a baseline beat position using modified discrete cosine transform
4 coefficients obtained from the audio bitstream;

5 deriving a search window-switching pattern from the audio bitstream;

6 determining a window-switching beat position using said search window-
7 switching pattern;

8 comparing said baseline beat position with said window-switching beat
9 position; and

10 validating said window-switching beat position as a detected beat if a
11 predetermined condition is satisfied.

1 2. A method as in claim 1 further comprising the step of determining an inter-
2 beat interval related to said baseline beat position.

1 3. A method as in claim 2 further comprising the step of storing said window-
2 switching beat position and said inter-beat interval for subsequent retrieval.

1 4. A method as in claim 1 wherein said step of determining a baseline beat
2 position comprises the step of determining at least one beat candidate and an inter-
3 onset interval.

- 1 5. A method as in claim 4 wherein said step of determining a baseline beat
2 position further comprises the step of checking said at least one beat candidate for
3 reliability using a predetermined confidence threshold value.
- 1 6. A method as in claim 4 further comprising the step of converging two or more
2 said beat candidates to a single beat candidate.
- 1 7. A method as in claim 1 wherein said step of deriving baseline beat information
2 from the audio bitstream comprises the step of deriving an energy value for at least
3 one subband from the compression encoded audio bitstream.
- 1 8. A method as in claim 7 wherein said subband comprises a member of the
2 group consisting of a frequency interval from 0 to 459 Hz, a frequency interval from
3 460 to 918 Hz, a frequency interval from 919 to 1337 Hz, a frequency interval from
4 1.338 to 3.404 kHz, a frequency interval from 3.405 to 7.462 kHz, and a frequency
5 interval from 7.463 to 22.05 kHz.
- 1 9. A method as in claim 7 wherein said step of deriving a beat position comprises
2 the step of identifying a maximum energy value within a search window.
- 1 10. A method as in claim 7 wherein said step of deriving an energy value for at
2 least one subband comprises the step of deriving an absolute energy value.
- 1 11. A method as in claim 7 wherein said step of deriving an energy value for at
2 least one subband comprises the step of deriving an element-to-mean energy value.
- 1 12. A method as in claim 7 wherein said step of deriving an energy value for at
2 least one subband comprises the step of deriving a differential energy value.

1 13. A beat detector suitable for placement into an audio device conforming to a
2 compression-encoded audio transmission protocol, said beat detector comprising:

3 a modified discrete cosine transform coefficient extractor, for obtaining
4 transform coefficients;

5 at least one band feature value analyzer for analyzing a feature value for a
6 related band;

7 a confidence score calculator; and

8 a converging and storage unit for combining two or more said analyzed band
9 feature values.

1 14. The beat detector as in claim 13 wherein said feature value comprises a
2 member of the group consisting of an absolute energy value, an element-to-mean
3 energy value, and a differential energy value.

1 15. The beat detector as in claim 14 further comprising an element-to-mean ratio
2 threshold comparator.

1 16. An audio encoder suitable for use with a compression-encoded audio
2 transmission protocol, said audio encoder comprising:

3 a beat detector including

4 a modified discrete cosine transform coefficient extractor, for obtaining
5 transform coefficients;

6 at least one band feature value analyzer for analyzing a feature value for a
7 related band;

8 a confidence score calculator; and

9 means for including beat detection information as side information in audio
10 transmission.

1 17. An audio decoder suitable for use with a compression-encoded audio
2 transmission protocol, said audio decoder comprising:

3 a beat detector for providing beat position information, said beat detector
4 including

5 a modified discrete cosine transform coefficient extractor, for obtaining
6 transform coefficients;

7 at least one band feature value analyzer for analyzing a feature value for a
8 related band;

9 a confidence score calculator; and

10 error concealment means for concealing packet loss in audio transmission by
11 utilizing said beat position to identify audio data for replacement of
12 packet loss.